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Letter to the Editor

Dynamic aspects of accommodation: age and presbyopia

Dear Editor

Mordi and Ciuffreda (2004) have used an objective infrared optometer to measure the dynamic aspects of accommodation with aging in a large well-designed study. Their study demonstrates no change in the time constant and peak velocity/amplitude of accommodation with age. Based upon this observation, the authors correctly conclude that their findings imply that presbyopia cannot be due to degeneration of the ciliary muscle or central and peripheral neuromotor control.

In an attempt to explain presbyopia, the authors assert that their observations are consistent with the Hess–Gullstrand theory of presbyopia, i.e. presbyopia is caused by a change in the biomechanical properties of the crystalline lens capsule or stroma. However, based upon recently published studies, the Hess–Gullstrand theory of presbyopia is no longer a viable explanation for presbyopia.

Krag and Andearessen (2003) have measured the stress–strain relationships in the anterior and posterior capsules of human crystalline lenses. They have concluded that: "The lens capsule becomes increasingly effective with age in transmitting forces to the lens substance" because of its age-related increase in thickness and not a change in its elastic modulus. While the capsule increases in thickness with age, the cortex of the crystalline lens softens with age (Subbaram, Gump, Bullimore, & Sooryakumar, 2002). This softening of the cortex should further enhance the transduction of zonular forces with age. Therefore, biomechanical changes of the crystalline lens capsule or stoma do not appear to be responsible for presbyopia.

The findings of Mordi and Ciuffreda (2004) are consistent with Schachar's theory of accommodation (Schachar, 1992, 1999; Schachar & Anderson, 1995), which states that presbyopia is due to normal age-related equatorial growth of the crystalline lens. The age-related increase in equatorial diameter of the crystalline lens (Bluestein, Wilson, Wang, Rust, & Apple, 1996; Sakabe, Oshika, Lim, & Apple, 1998) decreases the effective working distance, and stretch, of the ciliary muscle and thereby, reduces the amount of force the ciliary muscle can apply with increasing age. The observations of Mordi and Ciuffreda (2004) are a welcome addition to the understanding of the dynamics of presbyopia and provide further insight into its mechanism.

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